

Lesson Plan



Three Exotic Plant Diseases Threatening Florida



SART Training Media



Three Exotic Plant Diseases Threatening Florida

Lesson Plan

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ABOUT FLORIDA SART

SART is a multi-agency coordinating group consisting of governmental and private entities dedicated to all-hazard and disaster preparedness, planning, response and recovery for the animal and agricultural sectors in the state of Florida.

SART operates at the local level through county SART organizations.

SART utilizes the skills and resources of many agencies, organizations and individuals with its multi-agency coordination group structure.

SART supports the county, regional and state emergency management efforts and incident management teams.

SART Mission

Empower Floridians through training and resource coordination to enhance all-hazard disaster response and response for animals and agriculture.

SART Goals

- Promote the active engagement of each county coordinator who is responsible for animal and agricultural issues.
- Provide assistance in the development and writing of county ESF 17 plans.
- Promote the establishment of a county SART to work as a multi-agency coordination group to support emergency management and incident management teams.
- Provide training for all SART and animal and agriculture personnel.
- Identify county resources available for an emergency or disaster.
- Work to comply with the National Incident Management System (NIMS) document.

SUBJECT:	Introduce participants to three exotic plant diseases threatening Florida.
GOAL:	To provide team members with a basic understanding of three exotic plant diseases now threatening Florida agriculture – citrus greening, soybean rust and sudden oak death – and to recognize the consequences of their spread.

INTRODUCTION

This lesson plan, together with a workbook and PowerPoint presentation, are part of the SART training module for “Insect, Arthropod and Plant Issues” entitled *Three Exotic Plant Diseases Threatening Florida*. The mechanics of planning, organizing and publicizing a training event are covered in the companion piece, *Toolkit for Planning a Community-Based SART Training Event*. For information on obtaining this publication, please refer to the Resources section.

A PowerPoint presentation has been created to accompany this lesson. Throughout the lesson plan, box-like symbols have been placed in the margins to indicate that a PowerPoint slide is available for that section.

Approximately one hour should be allocated for this program.

SESSION OUTLINE

Part 1: Beginning the Workshop	5 minutes
Part 2: Citrus Greening	20 minutes
Part 3: Soybean Rust	10 minutes
Part 4: Sudden Oak Death	10 minutes
Part 5: Highlight Key Resources	5 minutes
Part 6: Summary	<u>10 minutes</u>
TOTAL	60 minutes

SPECIFIC LEARNING OBJECTIVES

At the end of this training unit, participants will be able to:

1. Name three exotic plant diseases threatening Florida.
2. Describe citrus greening and how it may be introduced.
3. Discuss options for combating citrus greening and identify the best one.
4. Describe one effect of soybean rust and tell how it was introduced
5. Identify the best option for combating soybean rust.
6. Identify the most important plant vector for the spread of soybean rust.
7. Name two syndromes of sudden oak death.
8. Name the SOD syndrome found in Florida and describe how it was introduced.
9. Identify three nursery species that serve as vectors for the leaf/twig blight syndrome of sudden oak death.
10. Identify key resources available for more information.

LEARNING ENVIRONMENT AND LEARNING AIDS

To complete this lesson plan, you will need:

PowerPoint Presentation *Three Exotic Plant Diseases Threatening Florida*.

To conduct this training unit, you will need:

A means to show the PowerPoint presentation: a computer with a projector.

(Note: Master black and white copies of the slides are included at the end of this manual if you prefer to use an overhead projector.)

Sufficient seating for all participants.

Each participant will need:

A pen or pencil.

Participant workbook or paper for notes.

BEFORE THE WORKSHOP

On the day of the workshop, check that equipment needed is in place. Double-check that electronic media works properly with the equipment you have. Also, make certain that any materials such as paper, workbooks and pens/pencils are available in sufficient numbers for all participants.

PART I: BEGINNING THE WORKSHOP

Time: 5 minutes

Focus: Explain purpose of workshop – Introducing participants to certain plant diseases that affect Florida agriculture.

Slides
1-5

Once all participants have taken their seats, welcome them to the *Three Exotic Plant Diseases Threatening Florida* workshop. Thank them for attending and congratulate them on taking the time to learn about these important threats to Florida's, and America's, agriculture industry. Remind them that the best way to respond to an agricultural emergency is to have a foundation of knowledge upon which to build.

During this introduction, you may choose to distribute the Pre-Test included in the Resources section of this manual. The Pre-Test is a good way to determine the exotic plant disease recognition skills that your audience currently possesses. Make sure to communicate to the participants that their Pre-Test answers, accurate or off-the-mark, are only meant to guide them through this learning experience.

This lesson plan can be used with agricultural and non-agricultural audiences. At the end of this training module, participants will be able to name and describe three exotic plant diseases threatening Florida, explain how these diseases were introduced, state the consequences of the introductions, tell who is involved in prevention, diagnosis and control, and identify key resources available for more information.

Remind attendees that the reason they are attending the workshop is because they realize the value of being prepared by having a disaster plan in place. They will carry the results of the workshop with them everywhere.

This introduction should not exceed five minutes unless the Pre-Test is to be completed, in which case another five minutes may be required. This is a time when the participants are getting comfortable with the workshop they have decided to attend, their surroundings and you as the presenter. Simultaneously, you are becoming comfortable with the participants, the material you are presenting, and with being a presenter.

Pay attention to time as participants will want to learn what you have to present AND will want to depart on time. If you find that you are nervous when you start, understand that this is a natural response to public speaking. These "nerves" can make people ramble, talk faster or talk slower than normal, or even forget the time altogether.

Nevertheless, even if participants enjoy what you are presenting, they will appreciate your discipline when the workshop ends on time.

Overview: The value of agriculture in Florida

Slide
6

Florida has about 17 million residents and of them, an estimated 1 ¼ million work in agricultural-related jobs. These people produce billions of market value agricultural products or about 3-5% of the agricultural products of the US as a whole. Florida's top commodities are: forestry products (\$8 billion), greenhouse and nursery products (\$1.6 billion), citrus (\$1.17 billion), cane for sugar (\$517 million), tomatoes (\$508 million) and dairy products (\$356 million).

PART 2: CITRUS GREENING

Time 20 minutes

Focus: Understanding and recognizing “citrus greening” and its potential consequences in Florida.

Importance of citrus in Florida

Slide
7

Citrus is one of Florida's largest agricultural commodities. Florida produces 80 percent of all US citrus. In total citrus production, the Sunshine State ranks 2nd in the world, following Brazil.

In 2002, Florida produced 287 million boxes (15 million metric tons) of citrus. The on-tree citrus value – before value added operations such as shipping and processing – was estimated at \$879 million. The post value-added worth was about \$9.13 billion.

Citrus accounts for about 90,000 jobs and 800,000 acres in cultivation in 32 counties; \$39 million in *ad valorem* (property) taxes; and \$900 million in taxes at all government levels.

Diseases threatening citrus in Florida

Slide
8

These eight diseases currently threaten to invade Florida's citrus groves. We will only talk about the first two, the most imminent threats, here because there is evidence that they may be about to arrive:

- A. citrus greening (*huanglongbing*),
- B. citrus variegated chlorosis (CVC)
- C. citrus chlorotic dwarf virus
- D. sweet orange scab

- E. black spot of citrus
- F. citrus leprosis virus
- G. lime witches' broom
- H. citrus sudden death

What is "citrus greening?"

Slide
9

Known in China for more than 100 years as "yellow dragon disease," each Asian country has its own name for citrus greening.

Brazil was the first country in the Western Hemisphere to be infected. It has probably been present there for some time, perhaps 6-7 years, and is widespread, possibly due to propagation sloppiness, outside the regulated channels. It is now found in Florida.

What are the effects of citrus greening?

Slides
10-17

Although the disease is called "citrus greening," the first apparent sign of infection may either be leaf mottling or the yellowing of entire tree sectors. This yellowing is not immediately uniform and can affect one branch without affecting others.

The progressive yellowing of the entire canopy follows yellow sectoring. Citrus trees, often known to bear fruit for 20-25 years or longer, usually die within one to three years. Upon infection, fruit ripens unevenly, quickly becomes misshapen and turns bitter. Seed growth is often aborted.

How is citrus greening spread?

The pathogen

For a disease to spread three things are required: an infectious organism called a "pathogen," a means of transmission called a "vector," and finally a host.

Slide
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The pathogen for citrus greening is a "phloem-limited fastidious bacterium" named *Candidatus Liberobacter*. It has three forms, none of which is directly detrimental to humans:

- African (*Candidatus Liberobacter africanus*) – shows symptoms at cool temperatures, 20°-25° C (68°-77° F).
- Asian (*Candidatus Liberobacter asiaticus*) – shows symptoms under both cool and warm conditions, up to 35° C (95° F).
- American (*Candidatus Liberobacter americanus*) – discovered in Brazil in July, 2004.

The vector

There are three methods by which *Candidatus Liberobacter* is transmitted: seeds and grafts from infected plants, and tiny, exotic flying insect called a psyllid.

Slide
19

Two different psyllids spread the citrus greening bacterium: African citrus psyllids, *Trioza erytreae*, found in Africa and Asian citrus, and *Diaphorina citri* in Asia. *Diaphorina citri* first appeared in Florida in about 1998 and quickly and thoroughly colonized the state's citrus.

This psyllid is a pest in its own right. The adult insect is easily disturbed and difficult to catch. Machinery or human activity in an orchard causes them to fly ahead of the disturbance. This has obvious disease distribution consequences. (Curiously, a variety of exotic psyllid, the melaleuca leaf weevil, *Oxyops vitiosa*, is being used to attempt to control the spread of melaleuca in south Florida.)

Slide
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The Host

No citrus species appears to be immune to citrus greening. It affects the whole plant: leaves, stems, roots, growing points, inflorescence, fruit and seeds. The pathogen is not evenly distributed in host plants.

Identification and control of citrus greening

Awareness by everyone involved in the production and distribution of Florida citrus, beginning with in-the-field observation is the path to prevent a major and costly outbreak of citrus greening.

One difficulty with identification and diagnosis is that symptoms can easily be confused with other problems related to poor horticultural care or nutrient deficiencies. Pale yellow leaves can resemble zinc or manganese deficiencies, for example.

Watch for yellowing tree canopy sectors, blotchy mottled leaves and small, lopsided fruit with aborted seed. Notches in leaves, however, are signs of psyllids feeding and will be accompanied by blotchy mottling of foliage, stunting and small, misshapen fruit.

Slides
21-27

Confirming a diagnosis for citrus greening is not easy, even in the laboratory, but anyone who suspects a greening or a psyllids infestation should contact their county agricultural agent or the Department of Agriculture & Consumer Services' *Help Line* – 1-888-397-1517. After that, control presently takes three forms, only one of which however is truly understood to be effective:

- Biological: Two psyllid parasites (*Tamarixia radiata* and *Diaphorencyrtus aligarhensis*) have been used with varying – admittedly minor – degrees of success in Asia and are being introduced in Florida.
- Chemical: In South Africa, pesticides have provided good control of psyllids and injecting tetracycline into infected trees has provided inconclusive results. (Because tetracycline is “bacteriostatic,” it creates residue problems and can be phytotoxic to plants, pesticide treatment is not considered curative and thus is not deemed practical on a wide-scale basis.) Because the pathogen has been found in Florida, chemical treatments to reduce psyllid infestations will almost certainly be important in the control equation.
- Cultural: Successful eradication assumes early detection and removal of infected plants as well as all citrus plants potentially infected or exposed within range of flying psyllids. If the disease is detected early enough, prospects for eradication are good, but the difficulty will be the extensive range of psyllid flight. For citrus canker, the exposure radius around an infected tree is 1,900 feet. For citrus greening, the exposure radius is 9/10 mile! This means we will need to destroy infected and *potentially infected* trees within an area 6.8 times as great as for canker eradication!

A compounding difficulty is the spread of infected psyllids from nursery plants. Orange jasmine, *Murraya paniculata*, is a preferred host of the Asian citrus psyllid. In fact, this psyllid has moved through Florida largely as a result of the sale of untreated orange jasmine in large retail stores.

Related: CVC – Citrus Variegated Chlorosis

Slide
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Symptoms of the disease CVC, caused by another exotic bacterium, *Xylella fastidiosa*, are quite similar to citrus greening. This bacterium is carried by tiny leaf-hoppers and sharpshooters. Leaves in an infected tree canopy show patchy yellowing with brown spots and even gummy-looking raised spots in yellow areas on the underside of leaves. Fruit is small, hard and bitter, sun burning easily and ripening quickly. The overall impact is the same as citrus greening.

PART 3: SOYBEAN RUST

Time 10 minutes

Focus: Understanding “soybean rust” and the consequences of its spread through Florida.

The importance of soybeans in Florida

Slide
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In 2004, Florida farmers planted about 20,000 acres in soybeans. This yielded a \$3 million crop. Soybeans are less than 1% of the total crops in Florida, which ranks 30th among states in the US. By comparison, Iowa, the #1 soy state in the US plants almost 11 million acres. Nevertheless, soybeans are valuable because they have diversification potential for many farms and are the only common plant source of “complete protein.”

What is soybean rust?

Remember that the path of an infectious disease is: organism or pathogen, carried by a vector or means of transmission, and finally landing on and infecting a host.

Slides
30-33

The pathogen for soybean rust is a fungus (*Phakopsora pachyrhizi* or *P. meibomiaae*), which is carried on a plant spore. Of the two, only *P. pachyrhizi* is of real concern. Spores are blown to hosts by the wind and there is not one specific host legume for this fungus. At least 31 legume species in 17 different genera, plus many more experimentally, can be infected and show rust symptoms in their stems, leaves and pods.

Soybean rust is native to Asia. It spread to Australia in the '80s, to Africa in the '90s, was noticed in Hawaii in '95 and in South America in 2001. Infected spores were apparently blown to the US from Venezuela in November 2004 by Hurricane Ivan. Today, rust is confirmed in Florida, Georgia, Alabama, Mississippi, Louisiana, North and South Carolina and Texas, as well as Mexico.

Although soybeans are not nearly as great a part of the Florida economy as citrus, Florida has become part of the chain of consequences, linking this disease in South America to northern states in which soybeans are economically very significant. Unfortunately, the pathogen survives winters on legume hosts in frost-free areas. Thus, it is here to stay.

Rust symptoms and impact.

Slides
34-37

When checking fields for soybean rust, pay special attention to:

- early planted fields with early maturing varieties,
- low-lying or protected fields with prolonged dew periods and
- fields with early canopy closure.

An infected plant will show small, necrotic raised pustules on the undersides of lower leaves, especially around bloom-time. Eventually, these pustules spread to upper leaves and the entire plant. (It helps to have a 10-20 power hand lens to identify pustules on the underside of early leaves.)

In the field, infected areas appear as defoliated to brown patches, but as the entire field becomes infected, these spots lose their distinctiveness.

To treat soybean rust effectively one needs a specific diagnosis from the county extension service. A *Phakopsora pachyrhizi* infection can be difficult for lay individuals to distinguish from similar-looking bacterial blights and pustules, downy mildew, brown spot, *cercospora* blight and frog-eye leaf spot.

Yield losses from an infestation of soybean rust can vary 10-80%. Early detection is critical for successful treatment and multiple applications of fungicide are necessary for effective management. Biologists hope that host resistance will eventually minimize rust impact.

Kudzu as host and vector.

Slides
38-39

One of our distinctive Southern vines, an exotic introduction once promoted for erosion control and other beneficial factors, is a primary vector and host for soybean rust – kudzu.

Declared a weed and a noxious pest by the US Department of Agriculture in 1972, kudzu is difficult to eradicate, even with repeated applications of herbicides (some of which actually stimulate its growth!). Under proper conditions, kudzu vines can grow as much as 60 feet a year!

So at this time, the very best solution for soybean rust is vigilance, multiple applications of appropriate fungicides to infected areas, and control of kudzu.

PART 4: SUDDEN OAK DEATH

Time 10 minutes

Focus: Understanding the two syndromes of sudden oak death and their potential for damage in Florida.

The importance of oak trees and nurseries in Florida

Slides
40-41

Sudden oak death or SOD affects both oak trees and certain nursery species, especially camellia, rhododendron and viburnum.

Although it is estimated that Florida is losing 1,200 acres of land per week to urban and suburban sprawl, about half the state (16 million acres or 25,000 square miles) is still covered in wild or managed forest, and oak is a dominant and readily identifiable species.

Forestry and forest products contribute nearly \$17 billion to the Florida economy each year. Most of the value of oak trees in the state is not in forest products however, but as shelter for wild animals and shade for residents. In addition, oak trees have an aesthetic value that cannot be estimated.

The impact of sudden oak death is already being felt in the greenhouse and nursery business sector, rated Florida's Number One agricultural "commodity." The greenhouse and nursery business in Florida, even larger than citrus, is \$1.6 billion or 11% of the US total.

What is sudden oak death or SOD?

Slides
42-43

The pathogen for sudden oak death is a curious, fungus-like living organism called *Phytophthora ramorum* and consequently, SOD is often referred to as "ramorum blight." *Phytophthora ramorum* has two "syndromes" or manifestations, a bark canker, which is lethal to some trees, and a leaf-and-twig blight, which may be very subtle and very common-looking. The leaf-and-twig blight is not normally lethal, but is detrimental to the health of a plant and leaves it susceptible to death from secondary infections.

Although it is also established now in Europe, the *Phytophthora ramorum* fungus probably arrived in the US on infected rhododendron from Asia. Today, it is thoroughly entrenched in California and found sporadically in Oregon, Washington and British Columbia.

What is happening in Florida?

Slide
44

Unfortunately, one of the two syndromes of sudden oak death arrived in Florida in the spring, 2004. The culprit was infected *camellia japonica* shipped to nurseries in Florida and 38 other states from Monrovia Growers in Azusa, California. Specialty Plants, a California mail-order nursery, also distributed infected bonsai camellias that originated with Monrovia. The disease was subsequently verified in 176 nurseries in 22 states.

A year later, Florida's Department of Agriculture and Consumer Services found SOD leaf and twig blight in six north Florida nurseries. All had received plants from Monrovia. In one of these nurseries, neighboring camellia not originating from Monrovia but mingled with Monrovia stock, were infected.

Other than *camellia japonica*, no other hosts have been found to carry *P. ramorum* in Florida, but in 2005, Monrovia again distributed affected plants, this time shipping infected *kalmia* to Georgia.

Checking for evidence of sudden oak death

Slides
45-47

Seepage and bleeding through the bark are visual indicators of the bark canker syndrome of SOD. At times, it has helped to cut away the bark to see the cambium layer (the woody layer) beneath to clearly identify it, but to date the canker syndrome is confined to the West Coast.

Only the leaf-and-twig blight has appeared in Florida. The host (and perhaps vector as well) is the camellia. Rhododendron and viburnum are also susceptible, however.

On infected camellia, leaf tips turn dark brown and the edges of the browned area appear indistinct. Brown spots dot the leaf. Lesions form and may progress down the petiole to the stem. Once on the stem, rapid bark peeling and plant death follow shortly.

Although SOD has not yet been detected on Florida rhododendron, symptoms are similar to those on camellia. Interestingly, rhododendron at Monrovia Growers have yielded several unknown species of *Phytophthora*.

At this time, about 70 plant hosts are known for the *Phytophthora ramorum* fungus.

PART 5: HIGHLIGHT KEY RESOURCES

Time 5 minutes

Focus: Give participants additional sources of information and support

Slide
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US Department of Agriculture, Animal and Plant Health Inspection Service (www.aphis.usda.gov/) The APHIS public citrus greening web site (www.citrusgreening.net). The USDA soybean rust web sites are (www.usda.gov/soybeanrust/ or www.sbrusa.net/) and the APHIS web site is (www.aphis.usda.gov/ppq/ep/soybean_rust/). Look at (www.na.fs.fed.us/spfo/pubs/pest_al/sodeast/sodeast.htm) for the USDA sudden oak death pest alert.

Florida Department of Agriculture and Consumer Services (www.doacs.state.fl.us/)

Florida State Agricultural Response Team (www.flkart.org)

Integrated Pest Management, IFAS Extension, University of Florida (<http://ipm.ufl.edu/>)

Southern Plant Diagnostic Network ([http://spdn.ifas.ufl.edu/Citrus%20 Greening.htm](http://spdn.ifas.ufl.edu/Citrus%20Greening.htm))

Soybean rust (www.aphis.usda.gov/ppq/ep/soybean_rust/)

California Oak Mortality Task Force (<http://nature.berkeley.edu/comtf/>)

The Nature Conservancy, Global Invasive Species Initiative (<http://tncweeds.ucdavis.edu/products/gallery/phyra1.html>)

PART 6: SUMMARY, DISCUSSION & WRAP-UP

Time 5 minutes

Focus: Re-iterate program objective: provide team members with the ability to identify three exotic plant diseases – citrus greening, soybean rust and sudden oak death – and to understand the consequences of their spread.

Slides
49-50

Florida's unique position as a sub-tropical north-south peninsula between the Atlantic Ocean and the Gulf of Mexico allow it to serve as a unique vector for many exotic plants and animals. Some may be beneficial, but many are not. The three disease organisms highlighted in this workshop – citrus greening, soybean rust and sudden oak death syndrome – are hostile to Florida's economy and way of life.

Unfortunately, of the three diseases – actually four, if CVC is considered –covered in our presentation, only soybean rust permits fairly certain field identification. Citrus greening and sudden oak death are good examples of the need to note anything out of the ordinary and be willing to sample it, and bring it quickly to the attention of your professional county agricultural extension staff or the Florida Department of Agriculture and Consumer Services *Help Line* (1-888-397-1517) for diagnosis.

Participant Evaluation

Three Exotic Diseases Threatening Florida

Please circle the number that best expresses your opinions about the following statements.

		Fully Disagree	Disagree	Neutral	Agree	Fully Agree
1.	The training unit's format was appropriate.	1	2	3	4	5
2.	The information presented is useful to me.	1	2	3	4	5
3.	The time it took to complete this module was acceptable.	1	2	3	4	5
4.	The threat that citrus greening poses to Florida's citrus industry was made clear.	1	2	3	4	5
5.	The variety of manners in which Florida, a "Sentinel State," can become host to exotic diseases is clear.	1	2	3	4	5
6.	It was explained that the three exotic diseases threatening Florida cannot be eradicated, but must now be managed.	1	2	3	4	5
7.	The path from entry into the U.S. to long-term infection – pathogen, vector and host – was well explained for each disease.	1	2	3	4	5
8.	Available up-to-date resources were clearly outlined.	1	2	3	4	5

We welcome your comments about this program:

Please use the back of this sheet for any further comments.
Thank you for your time.

PRE-TEST/POST-TEST

Slides
51-54

1. Name two of the top sectors (in terms of dollars) of Florida's agricultural economy.
2. Name the plant disease that is considered the greatest potential threat to Florida citrus.
3. (True/False) Called *huanglongbing* in China where it originated in the 19th century, citrus greening disease is carried by the Mediterranean Fruit Fly.
4. (True/False) In an orange grove, one result of citrus greening disease is green oranges.
5. (True/False) Citrus greening and the related plant disease CVC cannot spread to humans who consume infected fruit.
6. (Circle one) Soybean rust arrived in Florida in 2004 as a result of:
 - a. A terrorist cell
 - b. A homeowner planting exotic soybeans
 - c. A hurricane
 - d. The greenhouse effect
7. (Fill in the blank with the best answer) Soybean rust can rapidly destroy as much as _____ of a soybean crop.
 - a. 100% the first year
 - b. About half every year
 - c. 10-80 % depending on conditions
8. (True/False) Sudden oak death is a terrible infestation that now threatens Florida's forests.
9. (Fill in the blank) _____ What common flowering species has been most prominent in the spread of sudden oak death through America's network of plant nurseries?
10. (Fill in the blank) _____ is primarily responsible for preventing the introduction and spread of noxious plants and diseases in Florida.

Bonus Question: If you suspect a plant disease, whether an established and well-understood disease such as citrus canker or an emerging threat such as citrus variegated chlorosis, you should contact _____.

TEST ANSWER KEY

Slide
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1. Any combination of the following: cane for sugar, citrus, dairy, forest products, greenhouse/nursery products or tomatoes.
2. Citrus greening.
3. False. Citrus greening is spread by an exotic psyllid.
4. True. It also causes plants to yellow and fruit to shrivel.
5. True. Citrus greening and the similar CVC cannot be spread to humans.
6. A hurricane (Ivan in November 2004)
7. c. 10-80% depending on conditions
8. False.
9. Camellia
10. Various answers are acceptable, but they should indicate that everyone in Florida, whether they are involved in agriculture or not, have some responsibility as a citizen to prevent the spread of exotic plants and diseases.

Bonus Question: Contact your county agricultural extension office or the Department of Agriculture and Consumer Services *Help Line*: 1-888-397-1517.

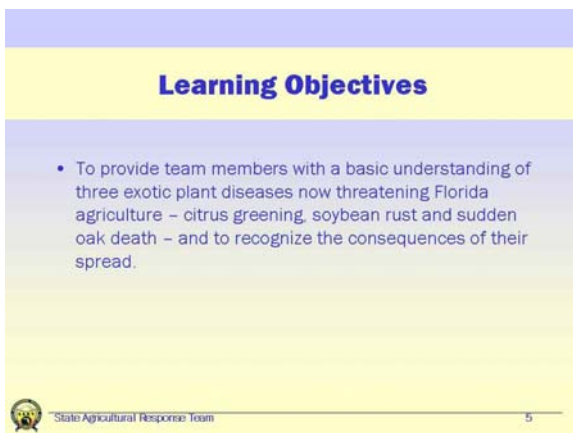
GLOSSARY

Slides
56-57

Host	A living plant or animal from which a parasite obtains nutrition.
Pathogen	Any disease-producing agent, such as a virus, bacterium or fungus.
SART	Florida State Agricultural Response Team. A multi-agency coordination group consisting of governmental and private entities dedicated to all-hazard disaster preparedness, planning, response and recovery for the animal and agriculture sectors in Florida.
Vector	Something, often an insect, that carries and transmits a disease-causing organism.

PowerPoint Slides

Slides 1-6



PowerPoint Slides

Slides 7-12

Importance of citrus in Florida



- Florida produces 80 percent of all US citrus
- Florida ranks 2nd in the world, following Brazil, in citrus production
- In total, citrus accounts for about 90,000 jobs in Florida and \$900 million in taxes at all government levels



State Agricultural Response Team

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Diseases threatening Florida citrus

- citrus greening
- citrus variegated chlorosis
- citrus chlorotic dwarf virus
- sweet orange scab
- black spot of citrus
- citrus leprosis virus
- lime witches' broom
- citrus sudden death



State Agricultural Response Team

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Citrus Greening



- Known in China for 100 years where it was called "yellow dragon disease"
- Has probably been in Brazil for 6-7 years where it is widespread possibly due to propagation sloppiness
- Now documented in Florida



State Agricultural Response Team

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What does citrus greening do?

- The first sign of infection may be leaf mottling or the yellowing of entire tree sectors. This sectoring will not usually be uniform and it can affect one branch without affecting others.
- Progressive yellowing of the entire canopy follows sectoring. Citrus trees may fruit for 20 – 25 years. After infection, they frequently succumb within one to three years; fruit ripens unevenly (remains "green") and may become misshapen; seed growth is often aborted.



State Agricultural Response Team

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Citrus Greening – Example 1



State Agricultural Response Team

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Citrus Greening – Example 2




State Agricultural Response Team

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PowerPoint Slides

Slides 13-18

Citrus Greening – Example 3



State Agricultural Response Team 13

Citrus Greening – Example 4






Photo: Stephen M. Gamsey
State Agricultural Response Team 14

Citrus Greening Up Close




State Agricultural Response Team 15

Citrus Greening – The Fruit #1



State Agricultural Response Team 16

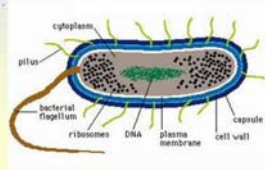
Citrus Greening – The Fruit #2



State Agricultural Response Team 17

How is citrus greening spread?

- A spreading disease requires a "pathogen," a means of transmission or "vector" and a host.
- The pathogen for citrus greening is *Candidatus Liberobacter*, a bacterium similar to the generalized form below.



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PowerPoint Slides

Slides 19-24

A “vector” carries the bacterium

- The bacterium is carried to its citrus host by a vector, in this case, a psyllid.
- This psyllid first appeared in Florida in 1998.
- Today, they are found throughout the state (adult pictured, right.)



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Florida’s Citrus Host

- No citrus is immune to citrus greening.
- It affects the entire plant: leaves, stems, roots, growing points, inflorescence, fruit and seeds.



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Who will help control citrus greening?



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21

Identifying citrus greening

- Yellow sectoring in trees
- Mottled, yellowing leaves
- Small, lopsided fruit
- Aborted, misshapen seed
- Notches in leaves
- Psyllids in the air



Results of feeding by citrus psyllids.



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22

Biological controls

- Two Asian parasites are planned for release in Florida:
 - *Tamarixia radiata* can reduce populations of citrus psyllid.
 - In the photo below, *Diaphorencyrtus aligarhensis* inserts an egg into a citrus psyllid nymph.



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23

Chemical controls



- Because the bacterial pathogen *Candidatus Liberobacter* has been found on psyllids in Florida, chemical controls will almost certainly be a part of the psyllid control equation.



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PowerPoint Slides

Slides 25-30

Cultural controls

- The only effective means of controlling an outbreak of citrus greening is the complete removal of infected trees and plants as soon as possible.

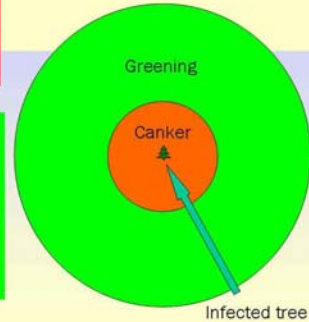


State Agricultural Response Team

25

Red: An exposure radius of 1,900 feet is used for citrus canker.

Green: The estimated exposure radius for citrus greening is 0.9 mile (how far Asian citrus psyllids can fly.) This involves 6.8 times the area for canker.



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26

Orange jasmine

- Orange jasmine or *Murraya paniculata* is a preferred host of the Asian citrus psyllid. This insect has moved through Florida via sales of orange jasmine in large retail stores.



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27

Related - CVC Citrus Variegated Chlorosis

- Like greening, CVC first appears as leaf mottling or yellow sectors in a tree. Symptoms resemble zinc or manganese deficiencies, which are common. Fruit are small and hard. A close up view of the symptomatic leaf with *intraveinal chlorosis* may show gummy-looking raised bumps in yellow areas on leaf undersides. Overall impact is the same as citrus greening.



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Part II: About Soybeans



- A native Asian plant. Soybeans are an important international crop because 40% of a bean is oil, 20% is protein and 35% carbohydrates.
- The US produces 55% of the world crop.
- Less than 1% of Florida's agricultural crop is soybeans.



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29

What is soybean rust?

- Soybean rust is a fungus, either *Phakopsora pachyrhizi* or *P. meibomia*. Of the two, only *P. pachyrhizi* is of real concern. Soybean rust is transmitted by wind-blown spores to host legumes.
- At least 31 legume species in 17 different genera, plus many more experimentally, can be infected.
- Like soybeans, soybean rust is native of Asia.
- Hurricane Ivan blew spores from Venezuela to the US in 2004.
- Today, rust is confirmed in Florida, Georgia, Alabama, Mississippi, Louisiana, North and South Carolina and Texas, as well as Mexico.

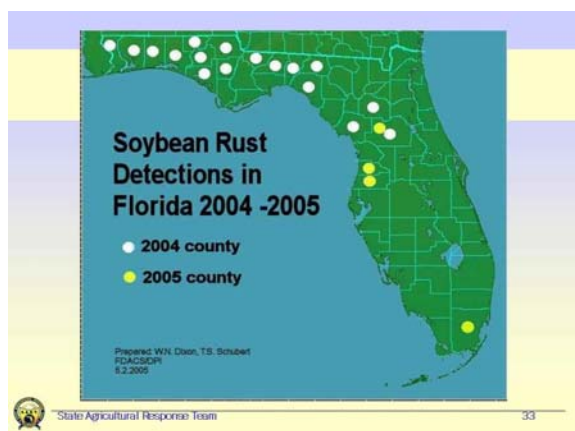
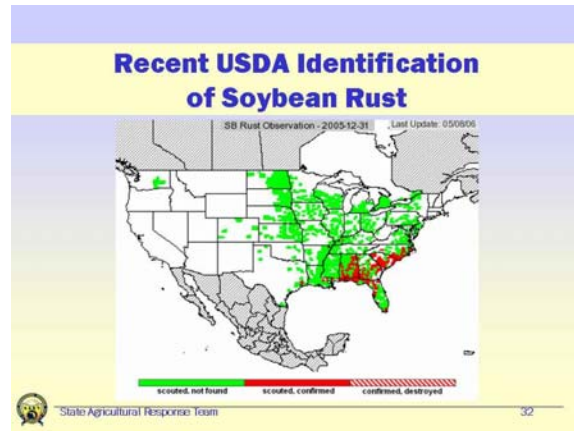
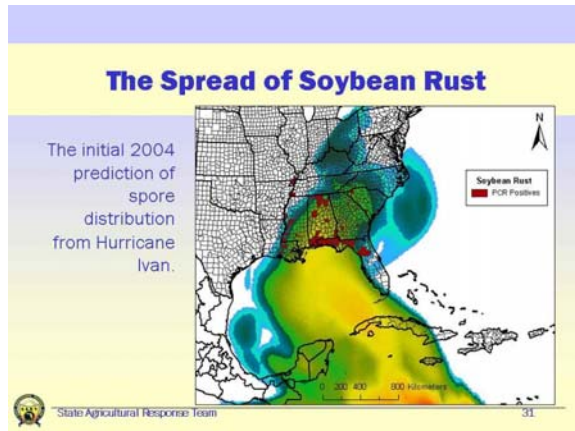


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PowerPoint Slides

Slides 31-36



Rust symptoms and impact

- Checking fields for soybean rust, pay attention to:
 - early planted fields with early maturing varieties,
 - low-lying or protected fields with prolonged dew periods and
 - fields with early canopy closure.

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Rust infection

- Look for small, necrotic raised pustules on the underside of leaves, eventually spreading to the entire plant.

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Soybean rust treatment

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PowerPoint Slides

Slides 37-42

The natural cure



Biologists hope that host resistance will minimize rust impact.



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Surprise host and vector! Can you identify this plant?



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Soybean rust in kudzu



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Part III: Sudden oak death



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SOD – Greatest Potential Impact

- Sudden oak death has greatest potential for harming Florida's booming nursery and greenhouse industry, an even larger sector of private industry jobs than citrus!



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41

What is sudden oak death?

- The pathogen: a fungus-like organism called *Phytophthora ramorum* probably arrived in the US on rhododendron imported from Asia.
- This infection has two "syndromes:"
 - Bark canker, established on the West Coast, is lethal to some trees, but has not been found in Florida.
 - Leaf-and-twig blight is not normally lethal, but is detrimental to plant health and was found in Florida in the Spring of 2004 and in 2006.



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PowerPoint Slides

Slides 43-48

SOD – Bark Canker Syndrome



- The SOD bark canker kills trees. Trimming away the bark can reveal the severity of the infection. It is not found in Florida.



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SOD – Leaf-&Twig Blight Syndrome



- *Camellia japonica* was the host when SOD leaf-and-twig blight entered Florida from a California nursery in 2003.



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What does SOD look like?



- SOD foliar stage of the leaf-and-twig blight syndrome on camellias. It is the only known host for *P. ramorum* in Florida ... so far!



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Ultimate leaf-and-twig syndrome.



Leaf and twig blight syndrome on *viburnum* have killed this plant.



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SOD on other hosts.



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47

Additional sources of information and support

- US Department of Agriculture, Animal and Plant Health Inspection Service www.aphis.usda.gov/, APHIS' on citrus greening www.citrusgreening.net, USDA's soybean rust web sites are www.usda.gov/soybeanrust/ or www.sbrusa.net/, APHIS web site is www.aphis.usda.gov/ppa/ep/soybean_rust/, The USDA on sudden oak death www.na.fs.fed.us/spfo/pubs/pest_ai/sodeast/sodeast.htm.
- Florida Department of Agriculture and Consumer Services www.doacs.state.fl.us/
- Integrated Pest Management, IFAS Extension, University of Florida <http://ipm.ufl.edu/>
- Southern Plant Diagnostic Network <http://spdn.ifas.ufl.edu/Citrus%20Greening.htm>
- Soybean rust www.aphis.usda.gov/ppa/ep/soybean_rust/
- California Oak Mortality Task Force <http://nature.berkeley.edu/comtf/>
- The Nature Conservancy, Global Invasive Species Initiative <http://tncweeds.ucdavis.edu/products/gallery/phyra1.html>



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PowerPoint Slides

Slides 49-54

Florida and The World



State Agricultural Response Team 49

Working Together To Protect Florida's Agriculture & Way of Life



State Agricultural Response Team 50

Now, Test Your Knowledge and Awareness (1 of 4)

1. Name two of the top sectors (in terms of dollars) of Florida's agricultural economy.
2. Name the plant disease that is considered the greatest potential threat to Florida citrus.
3. (True/False) Called *huanglongbing* in China where it originated in the 19th century, citrus greening disease is carried by the Mediterranean fruit fly.
4. (True/False) In an orange grove, one result of citrus greening disease is green oranges.

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Test continued (2 of 4)

5. (True/False) Citrus greening and the related plant disease CVC can not spread to humans who consume infected fruit.
6. (Circle one) Soybean rust arrived in Florida in 2004 as a result of:
 - A terrorist cell
 - A hurricane
 - A homeowner planting exotic soybeans
 - The greenhouse effect

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Test continued (3 of 4)

7. (Fill in the blank with the best answer) Soybean rust can rapidly destroy as much as ____ of a soybean crop.
 - 100% the first year
 - About half every year
 - 10-80% depending on conditions
8. (True/False) Sudden oak death is a terrible infestation that threatens to destroy all of Florida's forests.
9. (Fill in the blank) ____ What common flowering species has been most prominent in the spread of sudden oak death through America's network of plant nurseries?

State Agricultural Response Team 53

Test continued (4 of 4)

10. (Fill in the blank) ____ is primarily responsible for preventing the introduction and spread of noxious plants and diseases in Florida.

BONUS QUESTION – If you suspect a plant disease, whether an established and well-understood disease such as citrus canker or an emerging threat such as *citrus variegated chlorosis*, you should contact ____.

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PowerPoint Slides

Slides 55-57

Test Answer Key

1. Any combination of the following: cane for sugar, citrus, dairy, forest products, greenhouse/nursery products or tomatoes
 2. Citrus greening
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 4. True. It also causes plants to yellow and fruit to shrivel.
 5. True. Citrus greening and CVC cannot be spread to humans.
 6. A hurricane (Ivan in November 2004)
 7. 10-80% depending on conditions
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 9. Camellia
 10. All Floridians have a responsibility.
- Bonus: Contact your county agricultural extension office or the Dept. of Agriculture & Consumer Services Help Line: 1-888-397-1517.



State Agricultural Response Team

55

GLOSSARY

- Host: A living plant or animal from which a parasite obtains nutrition.
- Pathogen: Any disease-producing agent, such as a virus, bacterium or fungus.
- SART: Florida State Agricultural Response Team. A multi-agency coordination group consisting of governmental and private entities dedicated to all-hazard disaster preparedness, planning, response and recovery for the animal and agricultural sectors in Florida.
- Vector: Something, often an insect, that carries and transmits a disease-causing organism.



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56

**Three Exotic Plant Diseases
Threatening Florida**

- That concludes our presentation on "Three Exotic Plant Diseases Threatening Florida." Thank you for attending and for participating!



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PowerPoint Slides – Handout Pages

The *Three Exotic Diseases Threatening Florida* PowerPoint slides are reproduced on the following pages at reduced size with space for participant notes.

They are also included in the participant workbook for *Three Exotic Diseases Threatening Florida*, which is available on the SART web site at www.flsart.org.

Slides 1-3







Slides 4-6

Acknowledgements

- **Photographs and diagrams**
 - Department of Bacteriology, University of Wisconsin-Madison
 - Florida Dept. of Agriculture & Consumer Services
 - Institute of Food & Agricultural Sciences, University of Florida
 - Steve Koenning
 - Tim Schubert, PhD
 - Rick Sapp, PhD
 - US Department of Agriculture and USDA Forest Service

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4

Learning Objectives


- To provide team members with a basic understanding of three exotic plant diseases now threatening Florida agriculture – citrus greening, soybean rust and sudden oak death – and to recognize the consequences of their spread.

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The Value of Agriculture in Florida

- 1.25 million residents earn livings in agriculture producing billions in market value crops
- Florida's top agricultural sectors:
 - Cane for sugar
 - Citrus
 - Dairy
 - Forest products
 - Greenhouse/nursery products
 - Tomatoes

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Slides 7-9

Importance of citrus in Florida

- Florida produces 80 percent of all US citrus
- Florida ranks 2nd in the world, following Brazil, in citrus production
- In total, citrus accounts for about 90,000 jobs in Florida and \$900 million in taxes at all government levels



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Diseases threatening Florida citrus

- citrus greening
- citrus variegated chlorosis
- citrus chlorotic dwarf virus
- sweet orange scab
- black spot of citrus
- citrus leprosis virus
- lime witches' broom
- citrus sudden death



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8

Citrus Greening

- Known in China for 100 years where it was called "yellow dragon disease"
- Has probably been in Brazil for 6-7 years where it is widespread possibly due to propagation sloppiness
- Now documented in Florida



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Slides 10-12

What does citrus greening do?

- The first sign of infection may be leaf mottling or the yellowing of entire tree sectors. This sectoring will not usually be uniform and it can affect one branch without affecting others.
- Progressive yellowing of the entire canopy follows sectoring. Citrus trees may fruit for 20 – 25 years. After infection, they frequently succumb within one to three years: fruit ripens unevenly (remains "green") and may become misshapen; seed growth is often aborted.



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Citrus Greening – Example 1

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Citrus Greening – Example 2

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Slides 13-15

Citrus Greening – Example 3



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Citrus Greening – Example 4





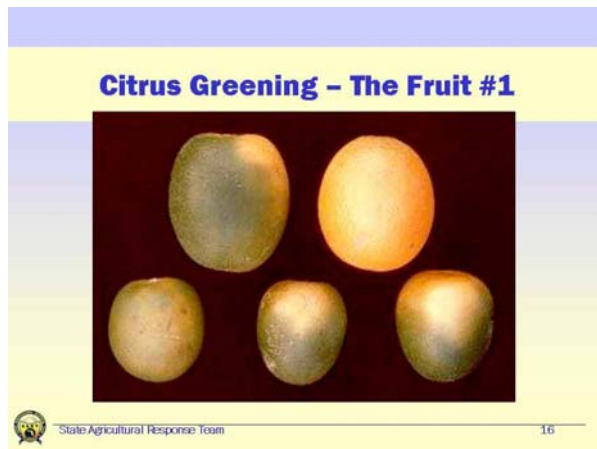
Photo: Stephen M. Garnsey
State Agricultural Response Team 14

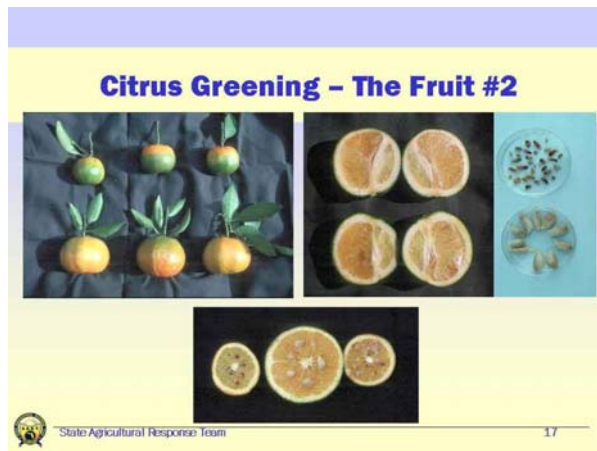
Citrus Greening Up Close

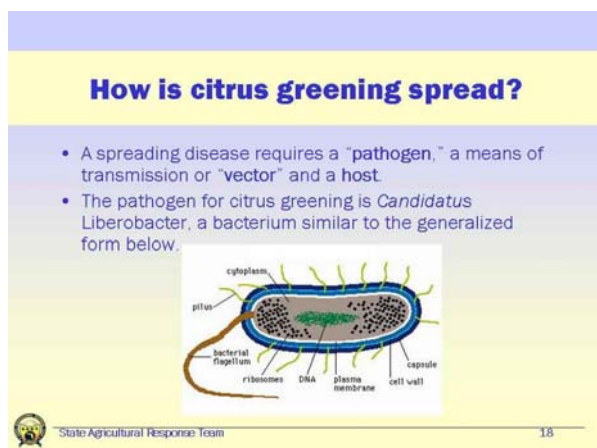


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Slides 16-18







Slides 19-21

A “vector” carries the bacterium

- The bacterium is carried to its citrus host by a vector, in this case, a psyllid.
- This psyllid first appeared in Florida in 1998.
- Today, they are found throughout the state (adult pictured, right.)



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19

Florida's Citrus Host

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20

Who will help control citrus greening?

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Slides 22-24

Identifying citrus greening

- Yellow sectoring in trees
- Mottled, yellowing leaves
- Small, lopsided fruit
- Aborted, misshapen seed
- Notches in leaves
- Psyllids in the air



Results of feeding by citrus psyllids.



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22

Biological controls

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23

Chemical controls



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Slides 25-27

Cultural controls

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25

Red: An exposure radius of 1,900 feet is used for citrus canker.

Green: The estimated exposure radius for citrus greening is 0.9 mile (how far Asian citrus psyllids can fly.) This involves 6.8 times the area for canker.



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26

Orange jasmine

- Orange jasmine or *Murraya paniculata* is a preferred host of the Asian citrus psyllid. This insect has moved through Florida via sales of orange jasmine in large retail stores.




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Slides 28-30


Related - CVC
Citrus Variegated Chlorosis

- Like greening, CVC first appears as leaf mottling or yellow sectors in a tree. Symptoms resemble zinc or manganese deficiencies, which are common. Fruit are small and hard. A close up view of the symptomatic leaf with *intraveinal chlorosis* may show gummy-looking raised bumps in yellow areas on leaf undersides. Overall impact is the same as citrus greening.



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Part II: About Soybeans



- A native Asian plant. Soybeans are an important international crop because 40% of a bean is oil, 20% is protein and 35% carbohydrates
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- Less than 1% of Florida's agricultural crop is soybeans

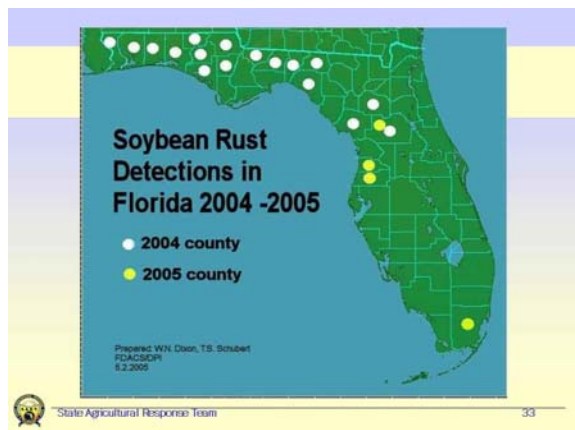
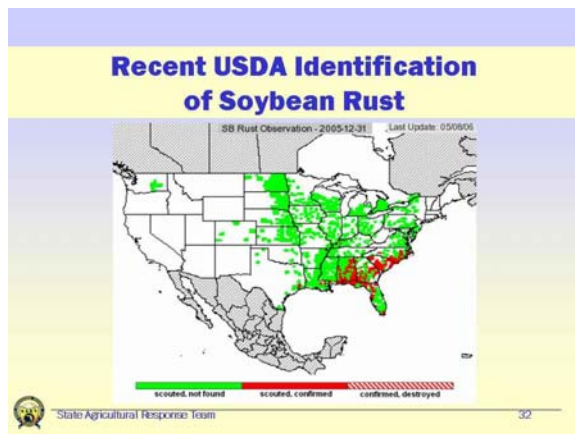
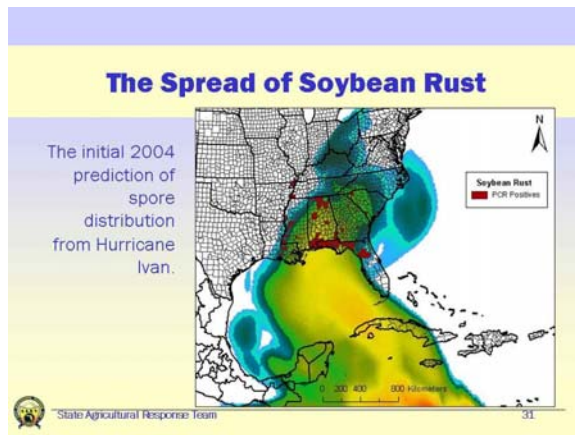
State Agricultural Response Team 29

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- Today, rust is confirmed in Florida, Georgia, Alabama, Mississippi, Louisiana, North and South Carolina and Texas, as well as Mexico.


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Slides 31-33




Slides 34-36

Rust symptoms and impact






- Checking fields for soybean rust, pay attention to:
 - early planted fields with early maturing varieties,
 - low-lying or protected fields with prolonged dew periods and
 - fields with early canopy closure.

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Rust infection

- Look for small, necrotic raised pustules on the underside of leaves, eventually spreading to the entire plant.




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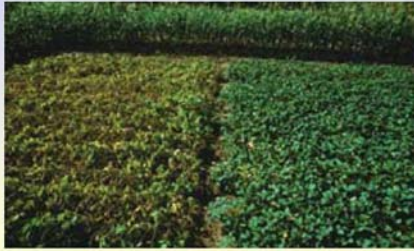
Soybean rust treatment



Unsprayed Sprayed once Sprayed twice

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Slides 37-39

The natural cure

Biologists hope that host resistance will minimize rust impact.



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37

**Surprise host and vector!
Can you identify this plant?**

Kudzu!

UGA0002155



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Soybean rust in kudzu

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Slides 40-42

Part III: Sudden oak death



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40

SOD – Greatest Potential Impact

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41

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Slides 43-45

SOD – Bark Canker Syndrome

- The SOD bark canker kills trees. Trimming away the bark can reveal the severity of the infection. It is not found in Florida.



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43

SOD – Leaf-&Twig Blight Syndrome

- *Camellia japonica* was the host when SOD leaf-and-twig blight entered Florida from a California nursery in 2003.



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44

What does SOD look like?

- SOD foliar stage of the leaf-and-twig blight syndrome on camellias. It is the only known host for *P. ramorum* in Florida ... so far!



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Slides 46-48

Ultimate leaf-and-twig syndrome.



Leaf and twig blight syndrome on *viburnum* have killed this plant.



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46

SOD on other hosts.



Quercus andrewsiana



Abies concolor



Taxus brevifolia



Taxus brevifolia

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47

Additional sources of information and support

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- The Nature Conservancy, Global Invasive Species Initiative <http://tncreeds.ucdavis.edu/products/gallery/phyra1.html>

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Slides 49-51

Florida and The World



A world map with Florida highlighted in orange. Lines radiate from Florida to various countries across all continents, including Canada, Mexico, Central America, the Caribbean, South America, Europe, Africa, Asia, and Australia. The map is color-coded by continent: North America (yellow), South America (green), Europe (blue), Africa (purple), Asia (red), and Australia (brown).

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Working Together To Protect Florida's Agriculture & Way of Life



A collage of five images: a tractor in a field, a person in a field, a person in a field, a person in a field, and a person in a field.

The End

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Now, Test Your Knowledge and Awareness (1 of 4)

1. Name two of the top sectors (in terms of dollars) of Florida's agricultural economy.
2. Name the plant disease that is considered the greatest potential threat to Florida citrus.
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Slides 52-54

Test continued (2 of 4)

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52

Test continued (3 of 4)

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State Agricultural Response Team

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Test continued (4 of 4)

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Slides 55-57

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State Agricultural Response Team

55

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56

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Threatening Florida**

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57

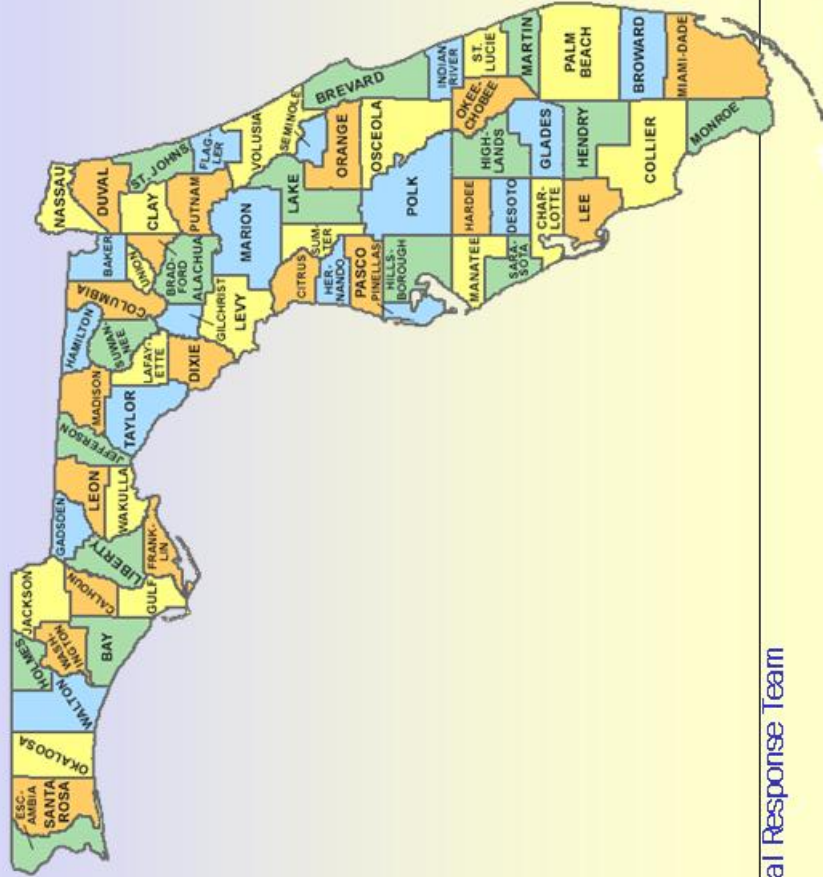
PowerPoint Slides – Full Size

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Color versions of these slides can be downloaded from the SART web site at www.flsart.org.



Three Exotic Plant Diseases Threatening Florida



Three Exotic Plant Diseases Threatening Florida

Prepared by

Tim Schubert, PhD

Florida Department of Agriculture and Consumer Services
Division of Plant Industry

Rick Sapp, PhD

Florida Department of Agriculture and Consumer Services,
Florida SART Technical Writer



Acknowledgements

- **Photographs and diagrams**

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- Institute of Food & Agricultural Sciences, University of Florida
- Steve Koenning
- Tim Schubert, PhD
- Rick Sapp, PhD
- US Department of Agriculture and USDA Forest Service



Learning Objectives

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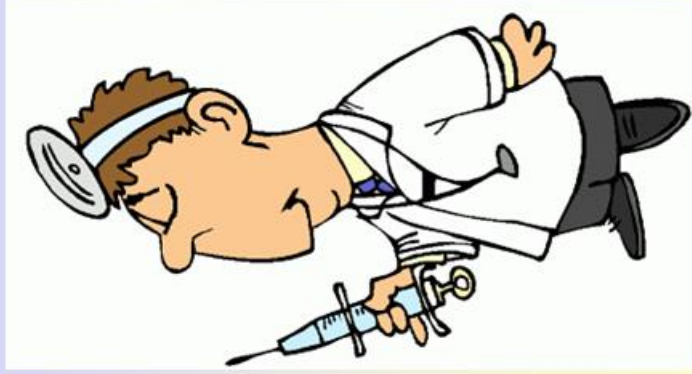
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What does citrus greening do?

- The first sign of infection may be leaf mottling or the yellowing of entire tree sectors. This sectoring will not usually be uniform and it can affect one branch without affecting others.
- Progressive yellowing of the entire canopy follows sectoring. Citrus trees may fruit for 20 – 25 years. After infection, they frequently succumb within one to three years: fruit ripens unevenly (remains “green”) and may become misshapen; seed growth is often aborted.



Citrus Greening - Example 1



Citrus Greening - Example 2



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Citrus Greening – Example 3



Citrus Greening – Example 4



Photo: Stephen M. Garnsey



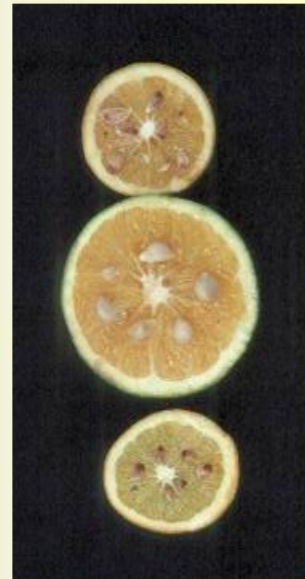
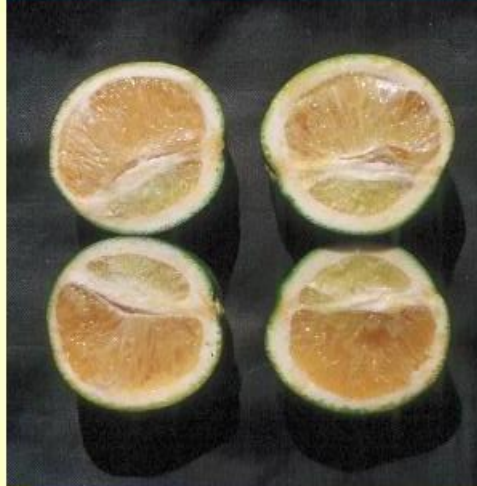
Citrus Greening Up Close



Citrus Greening – The Fruit #1

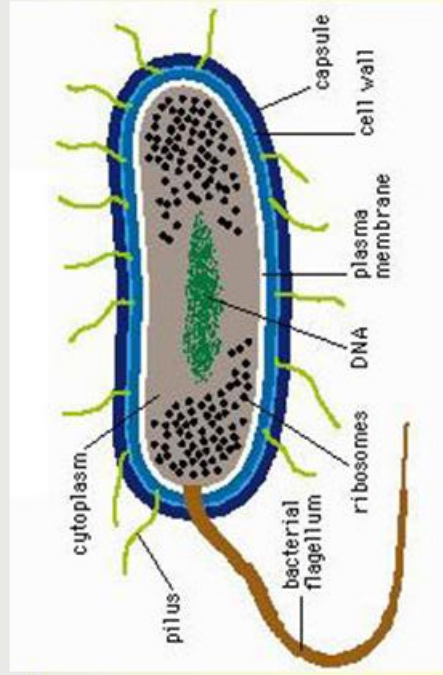


Citrus Greening - The Fruit #2



How is citrus greening spread?

- A spreading disease requires a “pathogen,” a means of transmission or “vector” and a host.
- The pathogen for citrus greening is *Candidatus Liberobacter*, a bacterium similar to the generalized form below.



A “vector” carries the bacterium

- The bacterium is carried to its citrus host by a vector, in this case, a psyllid.
- This psyllid first appeared in Florida in 1998.
- Today, they are found throughout the state (adult pictured, right.)



Florida's Citrus Host

- No citrus is immune to citrus greening.
- It affects the entire plant: leaves, stems, roots, growing points, inflorescence, fruit and seeds.



Who will help control citrus greening?



Identifying citrus greening

- Yellow sectoring in trees
- Mottled, yellowing leaves
- Small, lopsided fruit
- Aborted, misshapen seed
- Notches in leaves
- Psyllids in the air



Results of feeding by citrus psyllids.



Biological controls

- Two Asian parasites are planned for release in Florida:
 - *Tamarixia radiata* can reduce populations of citrus psyllid.
 - In the photo below, *Diaphorencyrtus aligarhensis* inserts an egg into a citrus psyllid nymph.



Chemical controls



- Because the bacterial pathogen *Candidatus* Liberobacter has been found on psyllids in Florida, chemical controls will almost certainly be a part of the psyllid control equation.



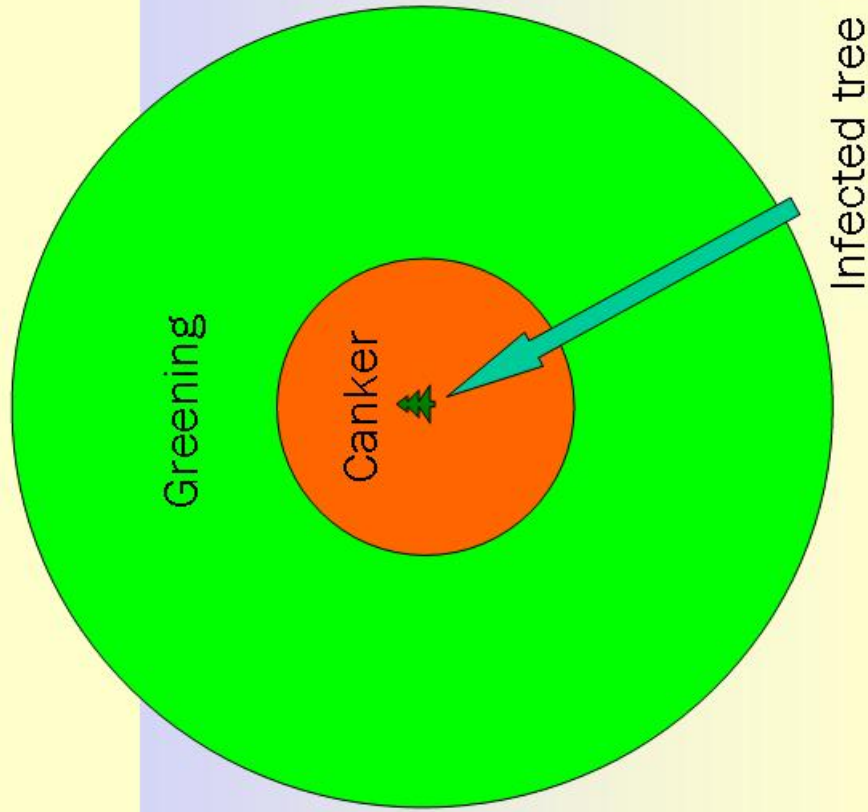
Cultural controls

- The only effective means of controlling an outbreak of citrus greening is the complete removal of infected trees and plants as soon as possible.



Red: An exposure radius of 1,900 feet is used for citrus canker.

Green: The estimated exposure radius for citrus greening is 0.9 mile (how far Asian citrus psyllids can fly.) This involves 6.8 times the area for canker.



Orange jasmine

- Orange jasmine or *Murraya paniculata* is a preferred host of the Asian citrus psyllid. This insect has moved through Florida via sales of orange jasmine in large retail stores.



Related - CVC

Citrus Variegated Chlorosis

- Like greening, CVC first appears as leaf mottling or yellow sectors in a tree. Symptoms resemble zinc or manganese deficiencies, which are common. Fruit are small and hard. A close up view of the symptomatic leaf with *intraveinal chlorosis* may show gummy-looking raised bumps in yellow areas on leaf undersides. Overall impact is the same as citrus greening.



Part II: About Soybeans



- A native Asian plant, Soybeans are an important international crop because 40% of a bean is oil, 20% is protein and 35% carbohydrates
- The US produces 55% of the world crop
- Less than 1% of Florida's agricultural crop is soybeans



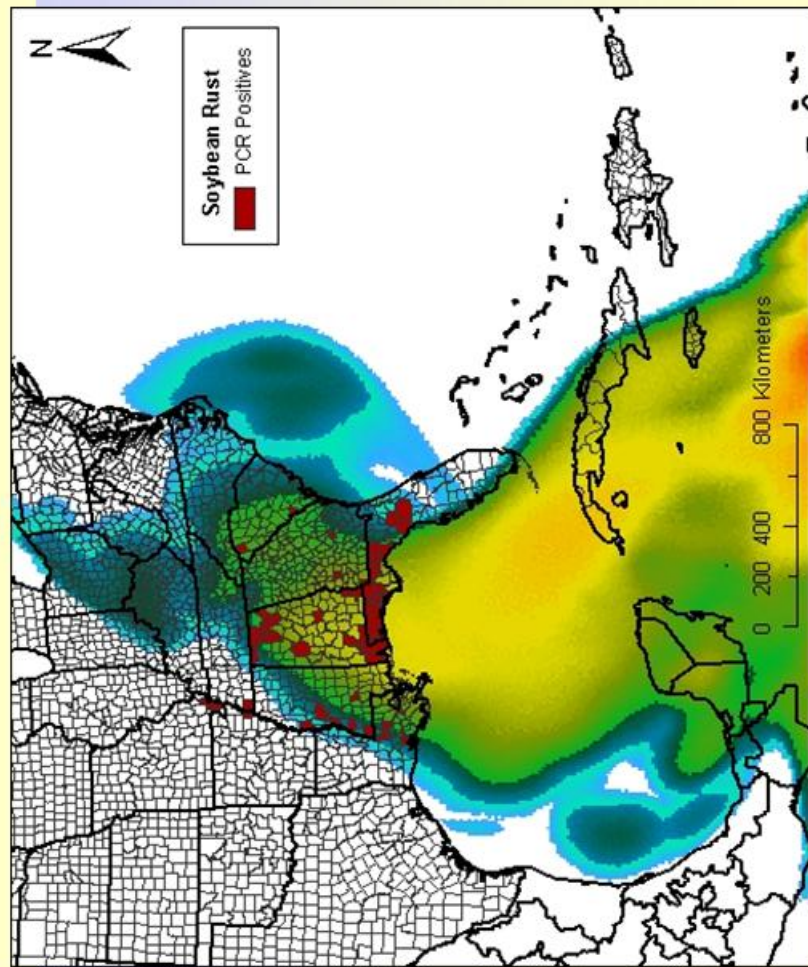
What is soybean rust?

- Soybean rust is a fungus, either *Phakopsora pachyrhizi* or *P. meibomia*. Of the two, only *P. pachyrhizi* is of real concern. Soybean rust is transmitted by wind-blown spores to host legumes.
- At least 31 legume species in 17 different genera, plus many more experimentally, can be infected.
- Like soybeans, soybean rust is native of Asia.
- Hurricane Ivan blew spores from Venezuela to the US in 2004.
- Today, rust is confirmed in Florida, Georgia, Alabama, Mississippi, Louisiana, North and South Carolina and Texas, as well as Mexico.



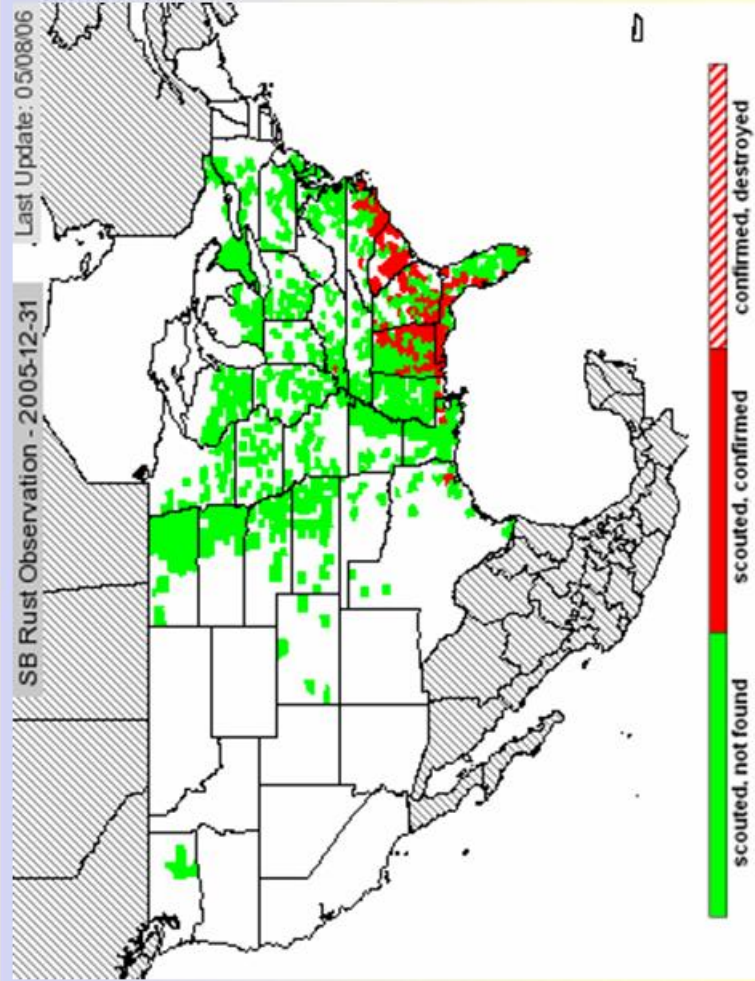
The Spread of Soybean Rust

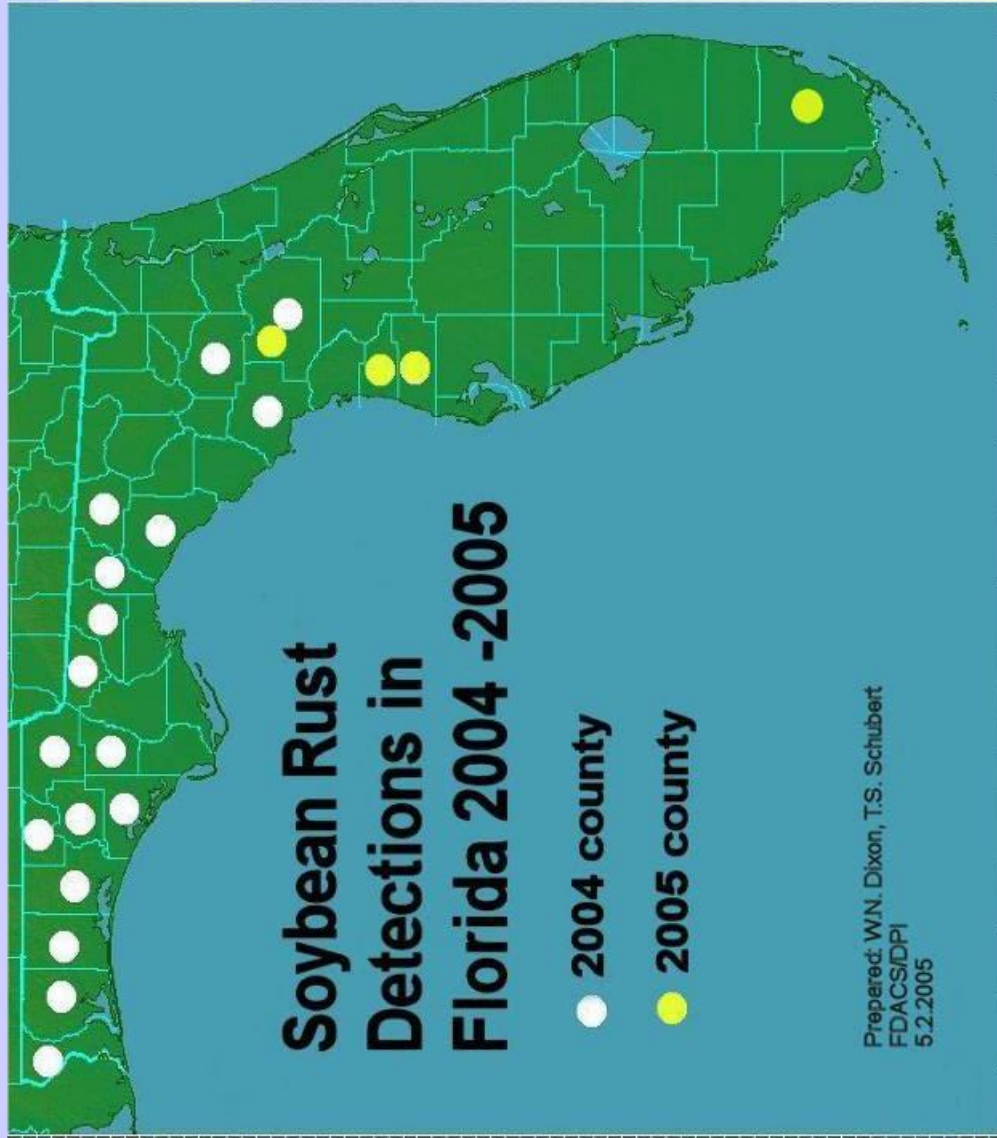
The initial 2004 prediction of spore distribution from Hurricane Ivan.



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Recent USDA Identification of Soybean Rust





Rust symptoms and impact



- Checking fields for soybean rust, pay attention to:
 - early planted fields with early maturing varieties,
 - low-lying or protected fields with prolonged dew periods and
 - fields with early canopy closure.



Rust infection

- Look for small, necrotic raised pustules on the underside of leaves, eventually spreading to the entire plant.



Soybean rust treatment



The natural cure



Biologists hope that host resistance will minimize rust impact.



Surprise host and vector! Can you identify this plant?



Soybean rust in kudzu



Part III: Sudden oak death



SOD – Greatest Potential Impact

- Sudden oak death has greatest potential for harming Florida's booming nursery and greenhouse industry, an even larger sector of private industry jobs than citrus!

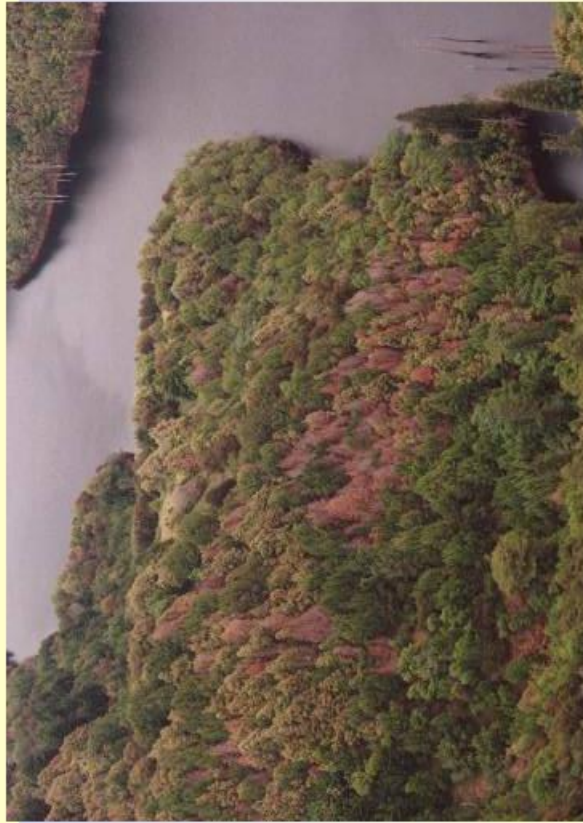


What is sudden oak death?

- The pathogen: a fungus-like organism called *Phytophthora ramorum* probably arrived in the US on rhododendron imported from Asia.
- This infection has two “syndromes.”
 - Bark canker, established on the West Coast, is lethal to some trees, but has not been found in Florida.
 - Leaf-and-twig blight is not normally lethal, but is detrimental to plant health and was found in Florida in the Spring of 2004 and in 2006.



SOD – Bark Canker Syndrome



- The SOD bark canker kills trees. Trimming away the bark can reveal the severity of the infection. It is not found in Florida.



SOD – Leaf-&-Twig Blight Syndrome



- *Camellia japonica* was the host when SOD leaf-and-twig blight entered Florida from a California nursery in 2003.



What does SOD look like?



- SOD foliar stage of the leaf-and-twig blight syndrome on camellias. It is the only known host for *P. ramorum* in Florida ... so far!



Ultimate leaf-and-twig syndrome.



Leaf and twig
blight
syndrome
on *viburnum*
have killed
this plant.



SOD on other hosts.



Additional sources of information and support

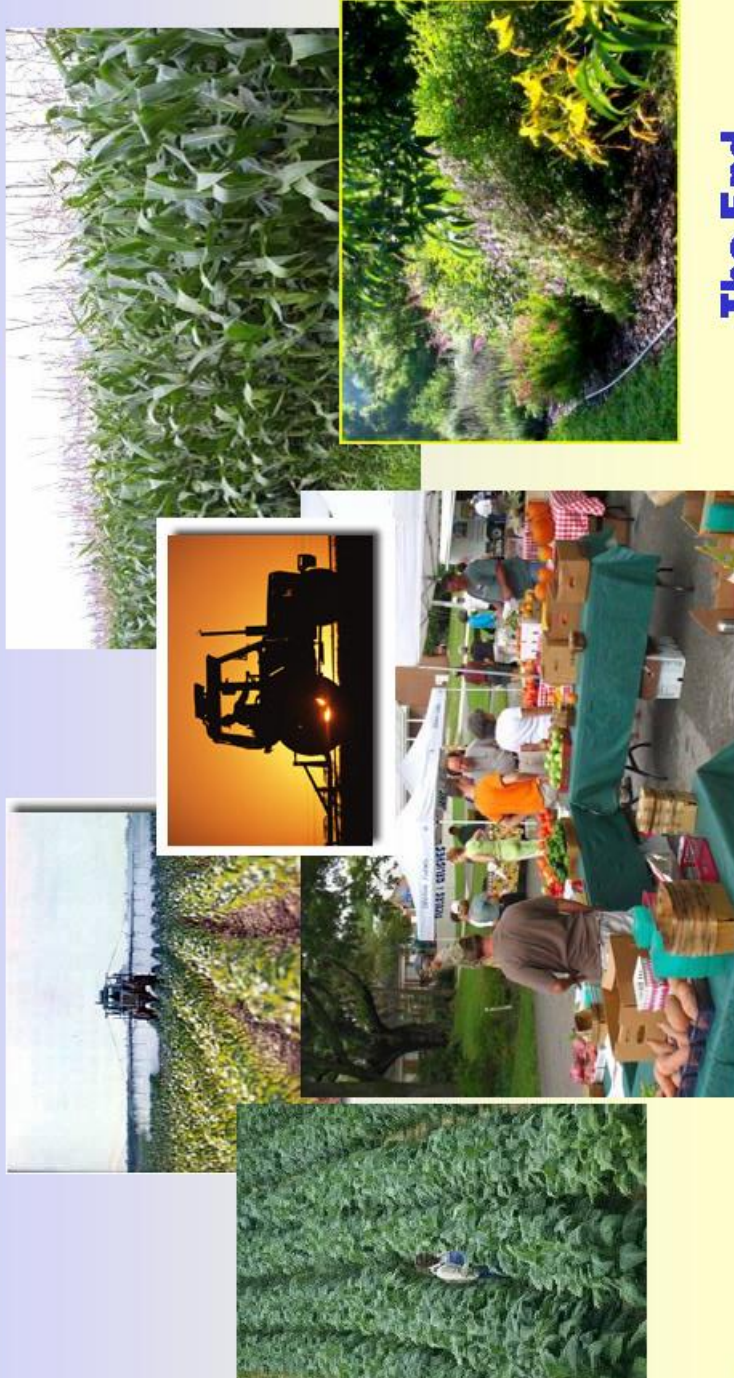
- US Department of Agriculture, Animal and Plant Health Inspection Service www.aphis.usda.gov/. APHIS' on citrus greening www.citrusgreening.net. USDA's soybean rust web sites are www.usda.gov/soybeanrust/ or www.sbrusa.net/. APHIS web site is www.aphis.usda.gov/ppq/ep/soybean_rust/. The USDA on sudden oak death www.na.fs.fed.us/spfo/pubs/pubs/pest_al/sodeast/sodeast.htm.
- Florida Department of Agriculture and Consumer Services www.doacs.state.fl.us/
- Integrated Pest Management, IFAS Extension, University of Florida <http://ipm.ufl.edu/>
- Southern Plant Diagnostic Network http://spdn.ifas.ufl.edu/Citrus%20_Greening.htm
- Soybean rust www.aphis.usda.gov/ppq/ep/soybean_rust/
- California Oak Mortality Task Force <http://nature.berkeley.edu/comtf/>
- The Nature Conservancy, Global Invasive Species Initiative <http://tncweeds.ucdavis.edu/products/gallery/phyra1.html>



Florida and The World



Working Together To Protect Florida's Agriculture & Way of Life



The End



State Agricultural Response Team

Now, Test Your Knowledge and Awareness (1 of 4)

1. Name two of the top sectors (in terms of dollars) of Florida's agricultural economy.
2. Name the plant disease that is considered the greatest potential threat to Florida citrus.
3. (True/False) Called *huanglongbing* in China where it originated in the 19th century, citrus greening disease is carried by the Mediterranean fruit fly.
4. (True/False) In an orange grove, one result of citrus greening disease is green oranges.



Test continued (2 of 4)

5. (True/False) Citrus greening and the related plant disease CVC can not spread to humans who consume infected fruit.
6. (Circle one) Soybean rust arrived in Florida in 2004 as a result of:
 - A terrorist cell
 - A hurricane
 - A homeowner planting exotic soybeans
 - The greenhouse effect



Test continued (3 of 4)

7. (Fill in the blank with the best answer) Soybean rust can rapidly destroy as much as _____ of a soybean crop.
- 100% the first year
 - About half every year
 - 10-80% depending on conditions
8. (True/False) Sudden oak death is a terrible infestation that threatens to destroy all of Florida's forests.
9. (Fill in the blank) _____ What common flowering species has been most prominent in the spread of sudden oak death through America's network of plant nurseries?



Test continued (4 of 4)

10. (Fill in the blank) _____ is primarily responsible for preventing the introduction and spread of noxious plants and diseases in Florida.

BONUS QUESTION – If you suspect a plant disease, whether an established and well-understood disease such as citrus canker or an emerging threat such as *citrus variegated chlorosis*, you should contact _____.



Test Answer Key

1. Any combination of the following: cane for sugar, citrus, dairy, forest products, greenhouse/nursery products or tomatoes
 2. Citrus greening
 3. False. Citrus greening is spread by an exotic psyllid.
 4. True. It also causes plants to yellow and fruit to shrivel.
 5. True. Citrus greening and CVC cannot be spread to humans.
 6. A hurricane (Ivan in November 2004)
 7. 10-80% depending on conditions
 8. False.
 9. Camellia
 10. All Floridians have a responsibility.
- Bonus: Contact your county agricultural extension office or the Dept. of Agriculture & Consumer Services Help Line: 1-888-397-1517.



GLOSSARY

- Host: A living plant or animal from which a parasite obtains nutrition.
- Pathogen: Any disease-producing agent, such as a virus, bacterium or fungus.
- SART: Florida State Agricultural Response Team. A multi-agency coordination group consisting of governmental and private entities dedicated to all-hazard disaster preparedness, planning, response and recovery for the animal and agricultural sectors in Florida.
- Vector: Something, often an insect, that carries and transmits a disease-causing organism.



Three Exotic Plant Diseases Threatening Florida

- That concludes our presentation on “Three Exotic Plant Diseases Threatening Florida.” Thank you for attending and for participating!



